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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

HUGHES, SCOTT A

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/604,878	Applicant(s) ESMERSON ET AL.	
	Examiner SCOTT A. HUGHES	Art Unit 3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 17 March 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 36-54 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 36-64 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submissions filed on 3/6/2009 and 3/17/2009 have been entered.

Response to Arguments

Applicant's arguments and amendments filed 3/6/2009 and 3/17/2009 have been fully considered but they are not persuasive.

Applicant cancelled the previously pending claims and added new claims 36-54. Applicant did not make arguments over the prior art of record with respect to the newly added claims. A summary of the discussion of the newly added claims from the interview on May 19, 2009 is presented in the Examiner Interview Summary dated 5/21/2009.

A new grounds of rejection of applicant's newly added claims 36-54 is presented below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

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invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 36-39, 41, 44-46, and 54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Ireson (6201765) and Stewart (ASEG/SEG Conference – Adelaide, 1988).

With regard to claim 36, Kan discloses a method of estimating velocity ahead of a drill bit disposed in a subsurface region (Column 8, Line 40 to Column 9, Line 10). Kan discloses obtaining surface seismic data for a region of interest (Column 6, Lines 20-37; Column 8, Lines 40-57). Kan discloses during drilling of a borehole traversing the subsurface region, determining a travel time of a seismic wave generated from a surface of the region to a location in the borehole when the drill bit is at selected depths in the borehole (Column 7, Line 66 to Column 8, Line 57). Kan discloses determining a velocity from the travel time and the selected depths (Column 8, Lines 1-57). Kan discloses inverting reflection seismic data (data reflected from structures below drillbit and received in the borehole receivers), although not specifically the surface seismic data, to determine a velocity ahead of the drill bit while constraining the velocity between the surface and the drill bit to be consistent with the velocity determined from the travel time (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Kan discloses that the VSP data is used to replace interval transit times from the surface seismic data with the velocity determined from the VSP checkshot survey to the depths of the borehole that the VSP data was taken. Replacing the velocity constrains it to being the velocity determined from the transit times of the VSP survey in the borehole.

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Kan discloses surface seismic data and discloses a plurality of surface located source and receiver locations used to take the surface seismic data as common midpoint data (Column 6) (Fig. 7a), but does not specifically disclose that a plurality of surface located sources and a plurality of surface located receivers are used to obtain the surface seismic data. Ireson teaches that it is known that surface seismic data are obtained using a plurality of surface sources and a plurality of surface receivers are used in obtaining surface seismic data (Fig. 1) (Column 1, Lines 9-40). It would have been obvious to use a plurality of sources and receivers to obtain the surface seismic data in Kan as taught by Ireson in order to obtain common midpoint data about an origin or midpoint.

Although Kan does not teach inverting the surface seismic data, Kan does disclose finding the velocities above the drill bit with the VSP, and then using this data in the process of finding interval velocities ahead of the bit by inversion methods for seismic data that has been reflected from structures ahead of the bit and received at receivers in the wellbore (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Kan teaches that the velocity determined from the surface seismic data is constrained by the velocity determined from the travel times and depths of the waves from the surface to the borehole location (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3), but does not specifically disclose that the velocity determined from the surface seismic data is determined by an inversion of the surface seismic data. Stewart teaches that inversion methods are used on both VSP and surface seismic data when determined velocity structures of underground formations (Page 358, Summary;

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Page 359, Second Column to Page 360 Second Column). It would have been obvious to use an inversion process on the surface seismic data in Kan to determine the velocity structure as taught by Stewart in order to determine the velocity structure of the subsurface in depth.

With regard to claim 37, Kan discloses transforming the velocity ahead of the drill bit into pore pressure of a region ahead of the drill bit (Column 6, Line 20 to Column 7, Line 21; Column 8, Lines 5-57).

With regard to claim 38, Kan discloses that the seismic wave is generated by a seismic source positioned near an opening of the borehole (Column 8, Lines 1-18).

With regard to claim 39, Kan discloses that determining the travel time of the seismic wave comprises detecting the seismic wave from at least one seismic receiver at location in the borehole (Column 8).

With regard to claim 41, Kan discloses that determining the travel time further comprises measuring the arrival time of the seismic wave detected at the seismic receiver and determining the travel time from the arrival time (Column 8, Lines 10-57).

With regard to claim 44, Kan discloses a method of estimating velocity ahead of a drill bit disposed in a subsurface region (Column 8, Line 40 to Column 9, Line 10). Kan discloses generating first seismic waves from a seismic source S located at a surface of the region (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57). Kan discloses obtaining surface seismic data associated with the first seismic waves at a plurality of locations R at the surface (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57). Kan discloses generating second seismic waves from the surface when the

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drill bit is disposed in a borehole (Column 8, Lines 1-57). Kan discloses obtaining seismic wave data associated with the second waves at one or more locations in the borehole (Column 8, Lines 1-57). Kan discloses inverting the obtained seismic wave data with reflection seismic data (data reflected from structures below drillbit and received in the borehole receivers) obtained for the region to determine a velocity ahead of the drill bit (Column 8, Line 40 to Column 9, line 3). Kan discloses inverting the obtained seismic wave data, but does not specifically disclose that the obtained surface seismic data is also inverted in the determination of the velocity.

Kan discloses surface seismic data and discloses a plurality of surface located source and receiver locations used to take the surface seismic data as common midpoint data (Column 6) (Fig. 7a), but does not specifically disclose that a plurality of surface located sources and a plurality of surface located receivers are used to obtain the surface seismic data. Ireson teaches that it is known that surface seismic data are obtained using a plurality of surface sources and a plurality of surface receivers are used in obtaining surface seismic data (Fig. 1) (Column 1, Lines 9-40). It would have been obvious to use a plurality of sources and receivers to obtain the surface seismic data in Kan as taught by Ireson in order to obtain common midpoint data about an origin or midpoint.

Although Kan does not teach inverting the surface seismic data, Kan does disclose finding the velocities above the drill bit with the VSP, and then using this data in the process of finding interval velocities ahead of the bit by inversion methods for seismic data that has been reflected from structures ahead of the bit and received at

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receivers in the wellbore (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Stewart teaches that inversion methods are used on both VSP and surface seismic data when determined velocity structures of underground formations (Page 358, Summary; Page 359, Second Column to Page 360 Second Column). It would have been obvious to use an inversion process on the surface seismic data in Kan as well as the VSP and checkshot data to determine the velocity structure as taught by Stewart in order to determine the velocity structure of the subsurface in depth.

With regard to claim 45, Kan discloses transforming the velocity ahead of the drill bit into pore pressure of a region ahead of the drill bit (Column 6, Line 20 to Column 7, Line 21; Column 8, Lines 5-57).

With regard to claim 46, Kan discloses that the surface seismic data is obtained for the subsurface region before the borehole is formed in the region (Column 6; Column 8, Lines 40-57).

With regard to claim 54, Kan discloses that the surface seismic data is obtained before commencement of drilling of the borehole (Column 6; Column 8, Lines 40-57).

Claims 40 and 42-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Ireson (6201765) and Stewart (ASEG/SEG Conference – Adelaide, 1988) as applied to claims 36-39 and 41 above, and further in view of Eaton (6382332).

With regard to claim 40, Kan does not disclose that the seismic receiver is disposed in a downhole tool near the drill bit. Kan discloses using the receiver during drilling, but does not disclose the location of the receivers used. Eaton teaches a

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method of determining time-depth check-shots and also obtaining VSP data using a downhole tool 14 that is located near the drill bit 13 (Fig. 1) (abstract; Column 2). It would have been obvious to modify Kan to include using a tool located near the drill bit for the receiver in the borehole in order to be able to take data without requiring that the drillstring be removed or that further devices are placed into the borehole.

With regard to claim 42, Kan does not disclose that measuring the arrival time comprises sending the seismic wave detected in the borehole to the surface and processing the detected seismic waves at the surface to determine arrival time. Kan does not disclose where the processing is performed. Eaton teaches that data obtained in receivers in a borehole can be sent to the surface for processing (Column 6, Lines 18-46). It would have been obvious to modify Kan to include sending the data to the surface to be processed as taught by Eaton in order to have a central processing unit at the surface that can perform all of the necessary data processing and also control the survey apparatus.

With regard to claim 43, Kan does not disclose that measuring the arrival time comprises processing the seismic wave detected in the borehole to determine the arrival time and sending the arrival time to the surface via telemetry. Kan does not disclose where the processing is performed. Eaton teaches that the data received in a borehole receiver can be processed in the receiver (Column 5, Lines 55-65; Column 6). It would have been obvious to modify Kan to include performing the processing in the borehole and sending the time to the surface via telemetry as taught by Eaton in order

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to reduce the data rate to a level commensurate with the link to the surface and to limit the amount of data that needs to be transmitted to the surface.

Claims 47-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Ireson (6201765) and Stewart (ASEG/SEG Conference – Adelaide, 1988) as applied to claims 44-46 above, and further in view of Leaney.

With regard to claim 47, Kan does not disclose that the surface seismic data is obtained for the subsurface region after the borehole is formed in the region. Leaney teaches taking VSP surveys in a borehole and then using the surveys to create models that are used to process surface seismic data (abstract; Column 3, Line 55 to Column 4, Line 68). It would have been obvious to modify Kan to include taking VSP survey data, and then acquiring surface seismic data and processing the surface seismic data as taught by Leaney in order to have a model of the velocity created from the VSP data that can be used to process surface seismic data that is taken in a region.

With regard to claim 48, Kan does not disclose that the surface seismic data is obtained for the subsurface region during drilling of the borehole is formed in the region. Leaney shows acquiring VSP and surface seismic data at the same time (Fig. 1) (abstract; Column 3, Line 55 to Column 4, Line 68). It would have been obvious to modify Kan to include taking both the data with the borehole receivers and the surface seismic data receivers at the same time as taught by Leaney in order to obtain a model from the VSP that is accurate for the formation at the time the surface seismic data are obtained.

Claims 49-51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Stewart (ASEG/SEG Conference – Adelaide, 1988)

With regard to claim 49, Kan discloses a method of estimating velocity ahead of a drill bit disposed in a subsurface region (Column 8, Line 40 to Column 9, Line 10). Kan discloses generating first seismic waves from a plurality of first locations at a surface of the region (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57) before the drill bit is drilling subsurface formations in a borehole traversing the subsurface (Column 6; Column 8, Lines 40-57). Kan discloses obtaining first seismic data associated with the first seismic waves at a plurality of second locations R at the surface of the region (Fig. 7a) (Column 6, Lines 20-37; Column 8, Lines 40-57) before the drill bit is drilling the subsurface formations in the borehole (Column 6; Column 8, Lines 40-57). Kan discloses generating second seismic waves from the surface of the region when the drill bit is drilling subsurface formations in the borehole (Column 8, Lines 1-57). Kan discloses obtaining seismic wave data associated with the second seismic waves at one or more locations in the borehole during drilling (Column 8, Lines 1-57). Kan discloses inverting the obtained second seismic wave data with reflection seismic data (data reflected from structures below drillbit and received in the borehole receivers) obtained for the region to determine a velocity ahead of the drill bit (Column 8, Line 40 to Column 9, line 3). Kan discloses inverting the obtained second seismic wave data, but does not specifically disclose that the obtained surface seismic data is also inverted in the determination of the velocity.

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Although Kan does not teach inverting the surface seismic data, Kan does disclose finding the velocities above the drill bit with the VSP, and then using this data in the process of finding interval velocities ahead of the bit by inversion methods for seismic data that has been reflected from structures ahead of the bit and received at receivers in the wellbore (Column 6, Lines 20-37; Column 8, Line 40 to Column 9, line 3). Stewart teaches that inversion methods are used on both VSP and surface seismic data when determined velocity structures of underground formations (Page 358, Summary; Page 359, Second Column to Page 360 Second Column). It would have been obvious to use an inversion process on the surface seismic data in Kan as well as the VSP and checkshot data to determine the velocity structure as taught by Stewart in order to determine the velocity structure of the subsurface in depth.

With regard to claim 50, Kan discloses transforming the velocity ahead of the drill bit into pore pressure of a region ahead of the drill bit (Column 6, Line 20 to Column 7, Line 21; Column 8, Lines 5-57).

With regard to claim 51, Kan discloses that the step of generating seismic waves is performed according to a predetermined sequence (different depths) and the obtained seismic wave information is performed corresponding to the predetermined sequence (Column 8, Line 1 to Column 9, Line 10).

Claims 52-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kan in view of Stewart (ASEG/SEG Conference – Adelaide, 1988) as applied to claims 49-51, and further in view of Eaton (6382332).

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With regard to claim 52, Kan discloses determining seismic travel times from a position of the generating seismic waves to the one or more locations in the borehole (Column 7, Line 66 to Column 8, Line 57). Kan does not disclose that a processor in the borehole does in the determining. Kan does not disclose where the processing is performed. Eaton teaches that the data received in a borehole receiver can be processed in the receiver (Column 5, Lines 55-65; Column 6). It would have been obvious to modify Kan to include performing the processing in the borehole and sending the time to the surface via telemetry as taught by Eaton in order to reduce the data rate to a level commensurate with the link to the surface and to limit the amount of data that needs to be transmitted to the surface.

With regard to claim 53, Kan discloses determining seismic travel times from a position of the generating seismic waves to the one or more locations in the borehole (Column 7, Line 66 to Column 8, Line 57). Kan does not disclose where the determining is performed. Eaton teaches that data obtained in receivers in a borehole can be sent to the surface for processing (Column 6, Lines 18-46). It would have been obvious to modify Kan to include sending the data to the surface to be processed as taught by Eaton in order to have a central processing unit at the surface that can perform all of the necessary data processing and also control the survey apparatus.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to SCOTT A. HUGHES whose telephone number is (571)272-6983. The examiner can normally be reached on M-F 8:30am to 5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Keith can be reached on (571) 272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Scott A. Hughes/
Examiner, Art Unit 3663